1-1-2001

Changing Wage Growth 1967-1997: Causes and Consequences: Dissertation Summary

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Causes and Consequences

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Young men today are significantly worse off than their counterparts who entered the labor market in the late 1960s. Starting wages for young men declined by nearly 10 percent between the late 1960s and late 1980s. Even college graduates experienced some decline in starting wages.[1] More importantly, the evidence suggests that most workers did not make up for the lost starting wages with higher wage growth. On average, young men entering the labor market during the late 1970s and 1980s experienced 15–20 percent less wage growth over the first 10 years of their careers than did young men who started working in the late 1960s. Furthermore, this overall decline was accompanied by other changes in the distribution of wage growth that appear to have exacerbated lifetime inequality between young men with different levels of education. Among cohorts that started working in the late 1960s, workers with a high school education or less experienced 68 percent wage growth over their first 10 years, while college graduates experienced 44 percent wage growth, indicating that returns to experience ameliorated inequality in starting wages among early cohorts. By the early 1980s, however, wage growth among college graduates had increased to between 50 and 60 percent, while wage growth among those with a high school degree or less had declined to between 40 and 45 percent. Thus, among more recent cohorts, changes in the returns to experience reinforce wage disparities across education groups.

The decline in wage growth among young men has important repercussions. Wage growth is one of the primary determinants of lifetime income, and thus these trends have the potential to impact life cycle decisions such as educational attainment, marriage, and home ownership. Moreover, lifetime earnings inequality reflects permanent differences in access to resources across individuals. Analysis of cross-sectional earnings, the focus of many recent studies, cannot provide information on this topic; in any given year, the distribution of wages may be largely driven by transitory shocks. Thus, by focusing on the structure of wage levels in the cross section, previous studies have ignored an important economic trend of the last 30 years. Because wage growth (either by itself or through its impact on lifetime earnings) affects so many individual consumption and investment decisions, understanding these trends is particularly important for public policy. Many public programs—ranging from the Earned Income Tax Credit to job placement services—focus on increasing employment and current earnings, while ignoring long-term considerations such as job mobility and wage growth. In doing so, these programs neglect an important incentive for individual behavior.

My dissertation documents the trends in wage growth and explores the implications of the observed changes, as well as possible factors that have contributed to the trends. The first chapter examines whether the decline in employment among low-skilled young men since the late 1960s can be explained by the decline in wage growth, which has reduced the value of work considerably. The second chapter details the increases in lifetime earnings inequality over the past 30 years and shows that they have been at least as great as the much more widely studied increases in cross-sectional inequality. Finally, the third chapter investigates the extent to which skill-biased technical change has been responsible for the observed changes in the structure of wage growth.

CHAPTER 1
LOOKING AHEAD: YOUNG MEN, WAGE GROWTH, AND LABOR SUPPLY

The first chapter examines whether the changes in wage growth described above can explain the decline in employment among young men that has occurred over the past 30 years. Much attention has been paid to the salubrious effects of the current economic expansion on the employment of young men (for example, Freeman and Rodgers 1999). However, the present rate of employment among young men still lags far behind those attained during the late 1960s. Annual participation (defined as the proportion of high school dropouts with one to five years of experience who

worked at least one week in a given year) declined 17 percent between 1967 and 1997, and annual participation among high school graduates declined 5 percent. While past studies have attributed the drop to declining wage levels or increases in unearned income (e.g., Juhn 1992), this paper argues that young men are forward-looking and take into consideration the opportunity for future wage growth as well as current wage levels in making their labor market choices. Thus, the large decline in wage growth among low-skill young men over the past 30 years is an overlooked explanation for the downward trend in employment.

Distinguishing between the effects of changing wage levels and changing wage growth is important. The decline in participation represents a large loss in productive capacity, and considerable resources are allocated toward increasing the labor market participation of young people through such mechanisms as training programs and the Earned Income Tax Credit. While these programs try to improve wage levels, they often fail to take wage growth into consideration and, as a result, neglect an important work incentive.

The traditional static model of labor supply is based on the assumption that the current wage level is a sufficient statistic for the value of employment. This model ignores the fact that employment also provides work experience and concomitant wage growth. For young people, wage growth is particularly high and, because they have a long time to benefit, returns to experience are likely to comprise a large part of the value of current employment. As wage growth changes, so too does the value of employment. A simple two-period model of labor with endogenous wages elucidates the way in which the labor supply decisions of young workers depend on wage growth. In the model, individuals maximize utility with respect to consumption and hours of work in each period. The wages of older workers (in the second period) are a function of hours worked when young (the first period) and an exogenous wage growth parameter.[2] Although the equation for labor supply does not have a closed form solution, I demonstrate that when the substitution effect is greater than the income and intertemporal substitution effects, an increase in wage growth induces more work among the young.[3]

Whether a change in wage growth actually affects employment is ultimately an empirical question. Thus, the next step is to estimate a model of labor supply in which individuals take into consideration wage growth as well as wage levels. Cohorts are defined by year of entry into the labor market following the completion of schooling. There are four education groups: high school dropouts, high school graduates, those with some college, and college graduates. The estimation is performed at the cohort level using artificial cohorts of young men from the CPS.[4] Due to sampling error, the cohort means obtained from the CPS are only error-ridden measures of the true cohort means. Therefore, an error-in-variables approach is used (Browning, Deaton, and Irish 1985; Deaton 1985). The resulting cohort-level error terms are heteroskedastic, a problem for which we correct. Two equations are estimated, an annual participation equation and an equation of hours of work conditional on positive participation.

The results show that indeed young men are forward-looking in their labor supply decisions. A 10 percent increase in the return to experience increases the annual participation rate by 0.6 percentage point and annual hours conditional on positive employment by 24 hours. As a point of comparison, a 10 percent increase in hourly wages increases the annual participation rate by 0.7 percentage point and annual hours by 28 hours a year. Thus we see that expected wage growth plays an important part in the labor supply decision. Moreover, our model is able to predict 40 percent of the fall in annual participation among high school dropouts between 1967 and 1977, a period of decline that previous studies have had difficulty explaining. In fact, if we hold wage growth constant at the 1967 level but allow wages and the remaining variables to vary, then we would actually expect to see a slight increase in participation over this period, suggesting that the decline in wage growth accounts for all of the explained decline in participation.

As noted, the estimation described above assumes that individuals have perfect foresight (or at least an unbiased estimate) of their average cohort/education group wage growth. This assumption was tested by reestimating the model with several alternative measures of expected wage growth. These include the five-year lag of five-year wage growth (which is akin to assuming that individuals take as their expected wage growth the actual wage growth of similar individuals five years ahead of them in the labor market); 10-year cross-sectional wage growth (which represents the case in which individuals expect to have the same wages in 10 years as similar individuals with 10 years more experience at a given point in time); and actual wage growth instrumented with cross-sectional wage growth (which captures the intuition that people combine some information about their own actual wage growth with information available in the cross section). This last measure performs the best. A 10 percent increase in

expected wage growth increases annual participation by 2.3 percentage points and annual hours of work by (a statistically insignificant) 23 hours. Thus, it seems that young men do take into consideration some expectation of their *ex post* wage growth.

This work makes several contributions to the existing literature. First, it demonstrates empirically the importance of forward-looking considerations in the labor supply decisions of young men. Although this issue has received considerable theoretical attention, it is not often considered in applied research or public policy. This suggests that policies aimed at increasing the labor market participation of young workers, either through training or the tax system, should take wage growth into consideration. Second, the study demonstrates that changes in wage growth are a key to understanding changes in employment over time, particularly among low-skilled young men. Past studies, including that of Juhn (1992), have had difficulty explaining the decline in labor market participation during the 1970s and attributed it to a shift in the labor supply curve. The results presented here indicate that a large part of that shift can be explained by changes in wage growth. There is also another possible interpretation. Traditional labor supply analysis plots participation against the wage. If instead we plot participation against the present discounted value of employment, then we can see the decline in labor market activity over the 1970s as a movement along this newly defined labor supply curve.

CHAPTER 2
LIFETIME INEQUALITY IS INCREASING TOO

The second chapter was prompted by the possibility that the changing structure of wage growth may have led to a decrease in lifetime earnings and an increase in lifetime earnings inequality. While a vast literature has explored the change in cross-sectional earnings inequality, fewer studies have examined changes in lifetime earnings inequality.[5] However, lifetime earnings are a better measure of individual access to resources, and lifetime earnings inequality is a better measure of the disparity in access. This chapter thus begins to fill a significant gap in our understanding of how the economic well-being of young men has evolved over the past 30 years.

We begin by analyzing the decline in lifetime earnings. Ten-year earnings, measured as the sum of earnings over the first 10 years of work, declined monotonically throughout the 30-year period.[6] Cohorts that entered the labor market between 1967 and 1970 earned $270,770 over the first 10 years of their career. In contrast, those entering the labor market in 1987 and 1988 earned $233,080—a loss of 14 percent, or $37,690. Of course, not all young men had the same experience. High school dropouts experienced a 33 percent decline in earnings, while those with a college degree experienced almost no decline. For all workers, declines in hourly wages explain the majority of the loss of earnings, but for workers with a high school degree or less, reductions in hours of work also play a significant role, explaining at least 70 percent of the decline in earnings during the 1970s and 20 percent of the decline during the 1980s.

The disparity in losses for workers with different levels of education suggests that this overall decline in lifetime earnings has been accompanied by an increase in lifetime earnings inequality. An examination of the 10-year skill premium shows this to be the case. For instance, we find that whereas college graduates entering the labor market in the late 1960s earned 2.6 times as much as their high school dropout compatriots over the first 10 years of their career, those entering the labor market in the late 1980s earned 3.7 times as much as the drop-outs over 10 years. The college graduate/ high school graduate lifetime earnings premium rose from 1.57 to 2.0 over the same time period. These increases in the lifetime earnings premium are greater than the corresponding increases in the cross-sectional earnings premium over the same time period.

Although the lifetime skill-premium can tell us on average how groups are doing relative to one another, it does not tell us what has happened overall to the dispersion of earnings or the dispersion of earnings within education groups. To answer these questions we focus on a measure of inequality which is common in the lifetime inequality literature: the coefficient of variation (cf. Gittleman and Joyce 1996; Lillard 1977; Parsons 1978).[7] In order to calculate the coefficient of variation, I use matched panels of the CPS, which track individuals over a period of two years.[8] The 10-year coefficient of variation rose 30 percent, from 0.39 for cohorts entering the labor market in the late 1960s to approximately 0.52 for those starting to work in the 1980s. This rise in inequality is due to increases in inequality both within and between education groups. The increase in inequality within education groups was in the range of 34–46 percent. It was highest for those with a high school degree or some college education and lower for high school dropouts and college graduates. To put these trends in perspective, I compare them with the changes in the coefficient of variation of cross-sectional earnings for those with 1–10 years of experience. I find that the coefficient of

variation of 10-year earnings rose faster than the cross-sectional coefficient of variation, indicating that the increases in cross-sectional inequality noted in previous studies are not being offset over the life cycle, but rather that a portion of the increase in cross-sectional inequality is persistent.[9]

It is also interesting to note that despite the large decline in hours of work among low-skilled young men, the increase in earnings inequality largely due to an increase in the variance of wages. The coefficient of variation of hourly wages increased by 25 percent on average from the mid 1970s to the early 1980s. Young men with low levels of education saw the largest increases in the wage inequality. Overall, there has been essentially no change in overall inequality of annual hours. Within education groups, the changes have also been small, on the order of 3–10 percent. Furthermore, these changes do not suggest a strong trend.

In summary, young men with a high school education or less who entered the labor market during the 1980s earned significantly less over the first 10 years of their careers than did cohorts that started working in the late 1960s. They are also worse off relative to their contemporaries with higher levels of education. The findings suggest that the increase in inequality observed in the cross section is not being offset by increased mobility over the life cycle and thus may require policy attention if it is to be ameliorated.

CHAPTER 3
TECHNOLOGY, DEMOGRAPHY, AND WAGE GROWTH

In this chapter, we explore possible explanations for the observed trends in wage growth over the past 30 years. We focus on two likely candidates: the changing relative supply of old and young, high- and low-skilled workers, which has resulted from the baby boom, and increased educational attainment and skill-biased technical change. Since the 1960s, the U.S. labor force has undergone dramatic changes. Between 1966 and 1981, the number of young men with one to five years of work experience increased over 70 percent, from slightly more than 13 million to nearly 23 million. Moreover, these new workers were the most highly educated in our nation's history. The number of young people with a college degree increased by nearly 250 percent between 1966 and 1976.[10] Numerous studies at the time explored the impact of the large size and high education level of the baby-boom cohorts on the economic well-being of its members, and evidence from these studies suggests that the large size of the baby boom generation did depress the wage levels of the members. However, no effort has been made to follow up that work and determine how their wage growth was affected. The U.S. economy has also experienced technological advances that may have affected wage growth over time. If the bias of technical change has differed for old and young workers, then wage growth may have been affected as well.[11]

To disentangle these possible stories, a translog aggregate production function was estimated in which old and young, high- and low-skill workers are treated as separate inputs.[12] The production function also allows for the possibility of skill-biased technical change. Using the parameters estimated from this model, we quantify the contribution of changes in the size and composition of the labor force and changes in technology to the trends in wage growth.[13]

The results of the estimation are generally as would be expected: all the own elasticities are negative. Although no studies disaggregate workers by both experience and education, previous studies did aggregate workers by either age or education. For the most part, our elasticities have the same sign as earlier estimates and are of comparable magnitude. The data clearly reject the hypothesis of Hicks neutral technical change. The conventional wisdom is that there has been skill-biased technical change in favor of high-skilled workers. Our data tell a somewhat more complicated story. While there has been technical change away from low-skilled workers, it has been born entirely by older workers. The measure of skill-biased technical change for low-skilled young workers is small and statistically insignificant. Interestingly, there is no evidence of skill-biased technical change toward older high-skilled workers, while there has been a small but statistically significant technical shift away from high-skilled young workers.

Finally, we use the estimated parameters to decompose the changes in wage growth (Table 1). Low-skilled workers entering the labor market in 1979 experienced a 14 percentage point decrease in wage growth relative to the 1969 cohort, while the more recent cohort of high-skilled workers experienced an 8 percentage point increase in wage growth relative to the earlier cohort. Our model predicts an 11 percentage point decline in wage growth for low-skilled workers and a 5 percentage point increase in wage growth for high-skilled workers. Turning to the details, we find that for low-skilled workers, technical change was the driving force behind observed patterns of wage growth, accounting for a 50 percentage point decline in wage growth *ceteris paribus*. The reason is that technical

Table 1 Decomposition of the Change in Wage Growth between the Cohort with 1–5 Years of Experience in 1969 and the Cohort with 1–5 Years of Experience in 1979

	Low-skill			High-skill		
	Old (e_{OLj89}*dlnX_{j89})	Young (e_{YLj79}*dlnX_{j79})	Total e_{OLj89}*dlnX_{j89})–(e_{YLj79}*dlnX_{j79})	Old (e_{OHj89}*dlnX_{j89})	Young (e_{YHj79}*dlnX_{j79})	Total (e_{OHj89}*dlnX_{j89})–(e_{YHj79}*dlnX_{j79})
1) Own-effect	–0.15	–0.13	–0.02	–0.07	–0.17	0.10
2) Technical change effect	–0.57	–0.07	–0.50	–0.12	–0.72	0.61
3) Capital effect	0.99	1.25	–0.26	–0.09	0.95	–1.04
4) Cross-effect	–0.39	–1.06	0.67	0.21	–0.17	0.38
5) Total predicted wage growth	–0.11	–0.01	–0.11	–0.07	–0.12	0.05
6) Actual wage growth	—	—	–0.14	—	—	0.08

NOTE: The variable e_{ijt} represents the partial elasticities of factor price. The letter j indexes the four labor inputs, capital, and technology (time). dlnX_{jt} is the change in the log quantity of factor j between times t and t–10. Numbers may not add due to rounding.

change depressed the wages of more recent cohorts of low-skilled old workers, while having little effect on young low-skilled workers. The second most important factor was the increase in the capital stock over this period, which increased the wages of young workers relative to old workers, thus decreasing wage growth by about 26 percentage points. The largest countervailing factor was the increase in the number of other types of workers. Since it is easier to substitute away from young low-skilled workers than old low-skilled workers, the increase in alternative types of workers depressed the wages of young workers by a greater amount, steepening the wage profile.

For high-skilled workers, the increase in wage growth was also largely due to technical change, which was biased in such a way as to lower the wages of young workers while leaving the wages of older workers relatively unchanged. The increase in the quantities of other types of workers also increased wage growth, by significantly increasing the wages of older workers who are complements with many other types of labor, while lowering the wages of young workers who are generally substitutes. The increase in the capital stock was the largest factor working to lower wage growth among high-skilled workers, by increasing the relative wages of young high-skilled workers. Although earlier research has made much of the depressive effect of large own-cohort size on wage levels, we find that the affect on wage growth was small compared with other factors: it marginally depressed the wage growth of low-skilled workers (since low-skilled workers were equally affected by their large cohort size throughout their lives) and increased the wage growth of high-skilled workers by 10 percentage points, as the depressive effects of large cohort size on high-skilled workers tended to dissipate over time.

This chapter takes an important step toward identifying the aggregate trends behind the changes in wage growth that have occurred over the past 30 years. It also gives us some insight into how wage growth will change in the future. Although future advances in technology are difficult to predict, the demographic changes facing the labor market in the next several decades can be foretold as, barring a dramatic increase in immigration. the potential workforce has already been born. *Ceteris paribus*, the relatively small generation that succeeded the baby boom is likely to experience a convergence in the wage growth of high- and low-skilled workers, while the members of the "baby-boom echo" will again see the wage growth rates of high-skilled workers outpace those of low-skilled workers. The paper also provides a basis for future research using microdata. It would be of particular interest to gain an understanding of why technical change affects old and young workers with the same level of education differently. The issue of why technical change should be biased against high-skill young workers seems especially important.

Taken together, these chapters have sought to document and explain the implications that recent economic changes have had on young workers

throughout the early years of their careers. The most important point is that for young workers with low levels of education, not only wages but also wage growth have declined, resulting in lower lifetime earnings, higher lifetime earnings inequality, and, as was shown in the first chapter, depressed labor market participation. Public policies aimed at improving outcomes for these young men must take into consideration the long-term nature of the problem. The chapters also make a methodological contribution by refining methods for using repeated cross sections of data and short panels to examine life-cycle issues. The advantages of the CPS are also inherent in a number of other datasets with similar structures, including the Consumer Expenditure Survey, the Survey of Consumer Finance and the Health and Retirement Survey. Therefore, the methodologies employed in these paper have a potentially great range of uses.

NOTES

This summary is from the author's doctoral dissertation at Columbia University; her advisor was Stephen Cameron. Dr. Aaronson is now with the Federal Reserve Board.

1. All calculations are the author's based on the 1968–1998 March Demographic Supplements to the Current Population survey (CPS), which refer to the years 1967–1997.
2. The source of wage growth in this model may derive from any number of sources, including (but not limited to) returns to experience, learning about the quality of a job march, or the back-loading for wages, as long as it is conditional on prior work experience.
3. Some of this same intuition can be found in the empirical results of Shaw (1989) and Wolpin (1992), although the methodology of those papers is very different from the work presented here.
4. Although there are several panel data sets which could have been used for much of the analysis presented here, the CPS has several advantages. At least 30 years of data are available, allowing for an exploration of the trends in employment over time. Furthermore, the large sample sizes allow for more detailed analysis of subsamples of the population. The advantages of the CPS are discussed in greater detail in the first two chapters of the dissertation.
5. Exceptions include Bernhardt, Morris, and Handcock (1998), Haider (1998), and Gittleman and Joyce (1996). A number of studies have examined the related issue of mobility, including Moffit and Gottschalk (1995) and Buchinsky and Hunt (1996).
6. We choose to follow the men for 10 years because by that time they will have experienced most of the wage growth that will occur over their careers (Murphy and Welch 1990). Choosing a longer time period would reduce the number of cohorts we observe without adding much information on earnings.
7. The dissertation includes a complete discussion of the relative merits of using the coefficient of variation to measure earnings inequality.
8. For an overview of the matched CPS, see Peracchi and Welch (1995).
9. Evidence of the increase in the variance of the persistent component of the earnings has been presented by Cameron and Tracy (1998), among others.
10. During this time there was also a dramatic increase in the number and proportion of women participating in the labor force. In this study we do not isolate the effect of the increase in female labor force participation, although we do attempt to control for the change in the composition of the workforce that results from their higher rates of participation.
11. Another possible explanation for the change in wage growth is a change in cohort quality. This issue is discussed more fully in the dissertation. Although we do not account for shifts in within-group quality, we do attempt to account for changes in cohort quality that might have occurred as a result of the changing composition of the labor force.
12. Low-skilled workers are all those with less than a college degree, while high-skilled workers have at least a college degree. "Young" workers are in the first five years of post-schooling work experience. All other workers are considered "old." A finer breakdown of workers was not possible due to data limitations. Although these are very broad groupings and do not correspond precisely to the definitions used in the earlier chapters, nonetheless, the same basic trends in wage growth are apparent.
13. Previous studies, notably Heckman, Lochner, and Taber 1998 and MaCurdy and Mroz 1995, have examined changes in wage growth over time, but the approaches differed significantly from the one pursued here and they did not attempt to decompose the underlying causes for the trends.

REFERENCES

Bernhardt, Annette, Martina Morris, and Mark Handcock. 1998. *Inequality and Mobility: Trends in Wage Growth for Young Adults*. Population Research Institute no. 99-03. University Park, Pennsylvania: Pennsylvania State University.

Browning, Martin, Angus Deaton, and Margaret Irish. 1985. "A Profitable Approach to Labor Supply and Commodity Demands over the Life-Cycle." *Econometrica* 53(3): 503–43.

Buchinsky, Moshe, and Jennifer Hunt. 1996. "Wage Mobility in the United States." Working paper no. 5455, National Bureau of Economic Research, Cambridge, Massachusetts.

Cameron, Stephen, and Joseph Tracy. 1998. "Earnings Variability in the United States: An Examination using Matched-CPS Data." October.

Deaton, Angus. 1985. "Panel Data from Time Series of Cross-Sections." *Journal of Econometrics* 30: 109–126.

Freeman, Richard B., and William M. Rogers, III. 1999. "Area Economic Conditions and the Labor Market Outcomes of Young Men in the 1990s Expansion." Working paper no. 7073, National Bureau of Economic Research, Cambridge, Massachusetts.

Gittleman, Maury, and Mary Joyce. 1996. "Earnings Mobility and Long-Run Inequality: An Analysis using Matched CPS Data." *Industrial Relations* 35(2): 180–196.

Haider, Steven. 1998. "Earnings instability and Earnings Inequality of Males in the United States: 1967–1991." University of Michigan, August 17.

Heckman, James J., Lance Lochner, and Christopher Taber. 1998. "Explaining Rising Wage Inequality: Explorations with a Dynamic General Equilibrium Model of Labor Earnings with Heterogeneous Agents." *Review of Economic Dynamics* 1(1): 1–58.

Juhn, Chinhui. 1992. "Decline in Male Labor Market Participation: The Role of Declining Market Opportunities." Quarterly Journal of Economics 107(1): 79–121.

Lillard, Lee A. 1977. "Inequality: Earnings vs. Human Wealth." *American Economic Review* 67(2): 42–53.

MaCurdy, Thomas, and Thomas Mroz. 1995. "Measuring Macroeconomic Shifts in Wages from Cohort Specifications." Revised, September.

Moffitt, Robert A., and Peter Gottschalk. 1995. "Trends in the Autocovariance Structure of Earnings in the U.S.: 1969–1987." Working paper no. 355, Department of Economics, Johns Hopkins University, Baltimore, Maryland.

Murphy, Kevin M., and Finis Welch. 1990. "Empirical Age-Earnings Profiles." *Journal of Labor Economics* 8(2): 202–229.

Parsons, Donald O. 1978. "The Autocorrelation of Earnings, Human Wealth Inequality, and Income Contingent Loans." *The Quarterly Journal of Economics* 92(4): 551–569.

Peracchi, Franco, and Finis Welch. 1995. "How representative are matched cross-sections? Evidence from the Current Population Survey." *Journal of Econometrics* 68(1): 153–179.

Shaw, Kathryn. 1989. "Life-Cycle Labor Supply with Human Capital Accumulation." *International Economic Review* 30(2): 431–456.

Wolpin, Kenneth I. 1992. "The Determinants of Black-White Differences in Early Employment Careers: Search, Layoffs, Quits, and Endogenous Wage Growth." *Journal of Political Economy* 100(3): 535–560.